Some Observations on the Biology of the Conchostracan Branchiopod [Crustacea], *Leptestheriella gigas* Karande & Inamdar, 1960

BY

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(*With a text-figure*)

INTRODUCTION

The present communication deals with the biology of the Conchostracan Branchiopod, *Leptestheriella gigas* Karande & Inamdar, 1960, which was noted living in association with *Triops orientalis* (Tiwari) during our study of the biology of the latter (*J. Bombay nat. Hist. Soc.* **56** : 215-225) and was later described as a new species (Karande & Inamdar, 1960).

MATERIAL AND METHODS

Specimens of *Leptestheriella gigas* were collected from the Tableland, Panchgani, in Maharashtra State. *L. gigas* are found here in temporary water pools from the middle of June to the end of November. As many as twelve trips were made to this place in 1957 during the monsoon when a large number of these forms were available.

OBSERVATIONS

Breeding activity

To study the breeding activity in *L. gigas* as many as 1372 specimens were collected during the different months of the year 1957. Careful examination and analysis of the collected material throws light on their egg-laying capacity, frequency of egg-laying, and the relation between body length and the number of eggs laid.

L. gigas is a prolific breeder and lays a large number of eggs, which remain attached to the exopods of the 10th and 11th limbs under the bivalve shells. The smallest size of the animal at the egg-laying stage

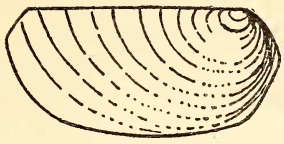

FIG. 1

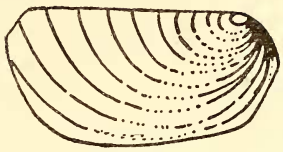

FIG. 2

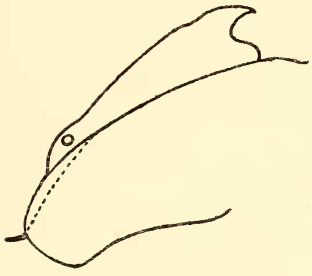

FIG. 3

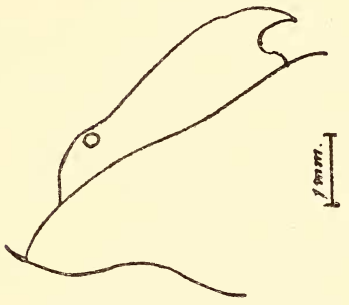

FIG. 4

FIG. 5

FIG. 6

Leptestheriella gigas

Fig. 1. Shell of male; Fig. 2. Shell of female; Fig. 3. Profile of male head; Fig. 4. Profile of female head; Fig. 5. 'Hand' first prehensile leg of male; Fig. 6. Exopod of the third male limb.

of this species is 7.5 mm., but the number of such egg-carrying females found was very small, only three in all the females examined. The smallest size at maturity is between 8.0 and 8.9 mm., when a large number of eggs are seen attached to the oostegopods of the limbs.

The minimum number of eggs laid by female *Leptestheriella* is 140, the maximum number recorded is 1240. The egg-laying capacity increases with the size, and therefore probably with the age, of the animal. A large number of females belonging to different size-groups were examined in every month. The following table gives the average number of eggs per female in each size-group in the whole season of the year 1957.

TABLE I

Average number of eggs per female in each size-group from June to November 1957

Size-group	June	July	August	September	October	November	Average
7.0-7.9 mm.	..	..	179	139	..	..	159
8.0-8.9 mm.	..	..	494	301	213	..	336
9.0-9.9 mm.	..	284	845	1136	628	..	723
10.0-11 mm.	..	..	824	1179	419	..	807

Table I reveals that there is a definite relation between egg-laying capacity and the length of the animal. This observation is supported by the findings made in the last two seasons.

It is further observed that the breeding capacity of the individual female increases gradually as it grows, so that the number of eggs laid by a female is more than a thousand at a time (Table I). The breeding activity gradually diminishes towards the end of the life span of the female. A large number of females measuring 11.0 mm. showed hardly 100 to 150 eggs. This number was much less than the average number of 807 eggs laid by this size-group (Table I).

It is not possible to find out exactly the number of times that a single individual lays eggs. The observations based on the collected data and supported by the laboratory findings indicate that each female lays eggs at least three times during its life span which is about fifty days.

Breeding period

The observations made here show that the breeding season in this species lasts for about four months though the temporary water pools are found for about six months and the individual life span is about fifty days (Table II). A large number of females were examined and the percentage of egg-carrying females is calculated for each month of the season. The following is the record of the same from month to month.

TABLE II

Percentage of egg-carrying females collected in every month

June	July	August	September	October	November
..	33.3%	74%	36.66%	50.61%	..

In the middle of June, at the commencement of the monsoon, a large number of *Leptestheriella* develop from the resting eggs.

In July breeding activity begins and 33.3% of all the females collected show eggs under their carapaces. These females belong to 9.0 to 9.9 mm. size-group, which constitutes 22.2% of the total females collected in this month (Table III).

August may be considered as the period of maximum breeding activity when the percentage of egg-carrying females is the highest. As many as 74% of the females collected in this month show the eggs attached to their oostegopods. The majority of these females belong to 9.0 to 9.9 mm. and the rest to 10.0 to 10.9 mm. size-group. The average number of eggs laid by these females was about 800 (Table I). This number though lower than that recorded in the following month of September, is of general occurrence and hence normal for this Indian species.

In September, the percentage of egg-carrying females diminishes but there is an increase in the number of eggs carried by each individual. In the first half of this month, the majority of the females reach a peak of breeding activity and more than a thousand eggs per female are seen under the bivalve shells (Table I). But after this, in the later half of the month, most of the females die and therefore the percentage of egg-carrying females drops.

In October, the percentage of egg-carrying females increases again and 50.61% of the females carry eggs as against 74% in August and 36.66% in September. The increase in the breeding is due to the individuals belonging to the second generation which emerge by the beginning of September (Table III).

In November, the temporary water pools on the Tableland start drying up and many individuals die. At the same time a new generation arises and most of them belong to 3.0 to 7.9 mm. size-group and are therefore all juveniles.

A monthwise account of the breeding activities in *L. gigas* further suggests that 9.0 to 9.9 mm. size constitutes the most active breeding group of females and forms the principal group amongst breeding females in every month of the season.

Sex ratio in *Leptestheriella gigas*

With a view to study the sex ratio in *L. gigas* more than a thousand specimens were carefully studied. The collected material is placed in different size-groups and the sex ratio is studied groupwise for every month of the season (Table III).

TABLE III

Monthwise frequency (in percentages) of males and females of *L. gigas* in different size-groups

Size-group	June		July		August		September		October		November	
	Male	Femal	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female
3.0 - 3.9 mm.	6.9	7.5	—	—	—	—	—	—	—	—	10	5
4.0 - 4.9 mm.	13.4	15.1	—	—	—	—	—	6.6	—	—	8	11
5.0 - 5.9 mm.	9.2	8.4	—	4.5	—	—	2.6	7.2	—	—	16	9
6.0 - 6.9 mm.	3.3	5.8	11.1	12.0	—	—	1.9	11.0	3.2	2.6	15	10
7.0 - 7.9 mm.	9.2	10.0	7.4	5.5	—	2.5	1.1	6.6	—	1.3	8	7
8.0 - 8.9 mm.	5.8	5.0	10.2	14.8	4.9	7.0	1	4.3	5.1	12.9	—	—
9.0 - 9.9 mm.	—	—	12	22.2	28.9	24.3	11.2	8.9	12.9	28.5	—	—
10.0 -11.0 mm.	—	—	—	—	19.1	13.1	20.0	16.9	16.1	17.4	—	—
No. of specimens	57	62	44	64	194	172	199	326	58	97	57	24

In June, with the onset of the monsoon, small-sized forms measuring between 3.0 to 8.9 mm. are available. In almost all the size-groups the ratio between the males and the females is found to be the same, though in a few cases there are more females than males.

In July, the forms measuring between 5.0 to 9.9 mm. are available. Amongst these the 9.0 to 9.9 mm. size-group is dominant. It may be said that *L. gigas* reaches a size of 9.9 mm. within one month's time. The number of females continues to be more than males in every size-group available in this month.

By the middle of August 32.2% of the total collected *Leptestheriella* attain the largest size, i.e. 10.0 to 11.0 mm. Others of the 9.0 to 9.9 mm. size-group constitute 53% of the total collection. The males outnumber the females particularly in the size-group 9.0 to 9.9 mm. This may be attributed to the death of a large number of females which have a shorter span of life than the males.

In September, a large number of young individuals develop which constitute a late or a second generation. In this month forms measuring between 4.0 to 11.0 mm. are found and majority of them belong to 9.0 to 11.0 mm. size-group. Once again the number of females is greater than that of males, but this is due to the emergence of the second

generation, the majority of which are small-sized females. In large-sized forms measuring 9.0 to 11.0 mm., belonging to the first generation, males outnumber females (Table III). This again shows that the males have a longer span of life than the females.

In October, forms measuring 6.0 to 11.0 mm. are available and it appears that most of them, except perhaps the very few measuring 10.0 to 11.0 mm., belong to the second generation. A majority of the forms observed during this period of the season are of 9.0 to 9.9 mm. size-group (41.1%), and are about one month old. In this month females outnumber males and, unlike previous monthly findings, this dominance is seen in every size-group, except 6.0 to 6.9 mm. which is the smallest available group.

In November, as already mentioned, a large number of *Leptestheriella* die due to unsuitable conditions prevailing in the ponds. But at the same time a third generation springs up. Majority of these belong to 3.0 to 7.9 mm. size-group. Here males outnumber females in most of the size-groups.

It has been noted by many workers that the eggs of many Branchiopods need desiccation prior to hatching. Pai (1959) has noted two types of eggs in the Estherid form she studied but observes that only one type is viable. The field observations made here tend to suggest that *L. gigas* lay two types of eggs. The eggs which hatch out in the month of June are summer eggs and therefore need desiccation. It appears that some eggs, however, need no desiccation and hatch out the very same year they are deposited by the females. This view is supported by the fact that egg-laying is at its maximum in August and October and the hatching in September and November. The eggs hatching in September and November, therefore, probably belong to the second category.

Habits

L. gigas are found in shallow ponds along with other Branchiopods like *Triops orientalis*, *Streptocephalus dichotomus*, and *Daphnia*. *L. gigas* are found in plenty particularly in shallow ponds with soft and muddy bottom, though they are not uncommon in deep rocky ponds. The temporary water-pools are at the most knee-deep and, therefore, it is very easy to catch them without the help of nets. These animals lay resting eggs like *Triops* which are able to withstand desiccation for considerable periods and may be collected during the dry season.

L. gigas are not active swimmers as compared to *T. orientalis* and other Anostracan form *S. dichotomus*. Normally they swim with their backs upwards but are occasionally seen swimming upside down like *Triops*. The limbs beat continuously throughout life, metachronal

waves passing forward. *L. gigas* are very rarely seen clinging to the blades of grasses though they do not feed on them. A large number of individuals are seen grubbing in the mud by means of their antennae and the anterior limbs. This form exhibits filter feeding. The animal buries itself inversely in the mud with the gape of the bivalve shell kept wide open. The anteriorly directed food-currents are formed by the metachronal movements of the limbs. They consume bacteria, protozoons, and diatoms. Examination of the contents of alimentary canals of a large number of individuals exhibit all these in addition to algae. The pinnate type diatoms and algae constitute the bulk of their food. *L. gigas* do not feed on any Crustaceans nor do they exhibit cannibalism as *Triops* do. Their only enemy appears to be *T. orientalis* which consumes them as food (Karande & Inamdar 1959).

Many individuals are seen in sexual union, and particularly so towards the end of the monsoon. The male and the female lie one behind the other in the same axis and the former catches hold of one of the bivalve shells of the latter by means of its claspers. The male bends its abdomen and rests against the ventral side of the female on 10th and 11th ovigerous legs which bear unfertilized eggs. The fertilization takes place outside the body and inside the bivalve shell. The larva is a nauplius.

Appendix A

Chemical analysis of the water in the temporary water pools at Tableland, Panchgani

		Parts per 100,000
1.	Total solids	19.98
2.	Volatile and organic matter	6.88
3.	Silica (SiO_2)	3.79
4.	Iron as Fe_2O_3	1.59
5.	Alumina (Al_2O_3) by difference	1.92
6.	Lime (CaO)	2.08
7.	Magnesia (MgO)	Traces
8.	Chlorides	0.70
9.	Sulphates	Nil
10.	Alkalinity as carbonates	0.79
11.	Alkali difference	2.23
12.	Hardness permanent	1.11
13.	Hardness temporary	0.58
14.	Hardness total	1.69
15.	Ammonia saline	0.049
16.	Ammonia albuminoid	0.011
17.	Nitrates	Nil
18.	Nitrites	Nil
19.	Phosphates	Traces
20.	Poisonous metals	Nil

Summary

A study of a Conchostracan Branchiopod *Leptestheriella gigas* collected at the tableland, Panchgani, Satara, Maharashtra, shows the following points of interests :

L. gigas is a prolific breeder, and the minimum size at maturity varies between 8.0 to 8.9 mm.

Minimum number of eggs deposited at a time by a female *Leptestheriella* is 140, whereas the maximum number recorded is 1240.

There appears to be a relation between the length of the animal and the number of eggs laid.

The egg-laying is at the maximum in August and October and the hatching of eggs in June, September, and November.

L. gigas attains a size of 10.0 mm. in about a month reaching a maximum size of 11.0 mm. during its lifetime.

In natural populations there are more females than males. In the large-sized stages males outnumber females. This is probably due to a shorter span of life in the females than in the males.

A possibility of *L. gigas* laying viable eggs which need no desiccation is suggested.

Field observations on feeding and breeding habits supported by laboratory findings are incorporated.

An analysis of the water in the temporary water-pools at Tableland, Panchgani, is appended.

Acknowledgements

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